

Claims

1. A process for producing a synthetic resin foam comprising the step of reacting at least one polyol with at least one polyisocyanate compound in the presence 5 of an organic blowing agent and a catalyst, wherein the blowing agent is a mixture comprising 1,1,1,3,3-pentafluorobutane and at least one halogen-containing compound.
2. A process according to Claim 1, wherein the 10 organic blowing agent further comprises at least one member selected from the group consisting of glycol compounds and amide compounds.
3. A process according to Claim 1, wherein the organic blowing agent further comprises at least one 15 glycol compound.
4. A process according to Claim 1 or 2, wherein the process comprises the step of mixing the organic blowing agent with the at least one polyol, a premix obtained according to the step being substantially 20 nonflammable.
5. A process according to Claim 1 or 2, wherein the halogen-containing compound has a boiling point lower than the boiling point of HFC-365mfc (40°C).
6. A process according to Claim 1 or 2, wherein 25 the halogen-containing compound is nonflammable and has a

boiling point of about 10 to about 60°C and a thermal conductivity when it is in the gaseous state of about 8 to about 20 mW/mK at about 1 atmospheric pressure.

7. A process according to Claim 2, wherein the  
5 halogen-containing compound is nonflammable and has a boiling point of about -90 to about 10°C and a thermal conductivity when it is in the gaseous state of about 8 to about 30 mW/mK at about 1 atmospheric pressure.

8. A process according to Claim 1 or 2, wherein  
10 the halogen-containing compound is at least one member selected from the group consisting of saturated or unsaturated hydrofluoroethers (HFEs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and fluoroiodocarbons (FICs).

15 9. A process according to Claim 1 or 2, wherein  
the halogen-containing compound is at least one member selected from the group consisting of 1,2,2-trifluoroethylene trifluoromethyl ether ( $\text{CF}_2=\text{CFOCF}_3$ ), 1,2,2-trifluoroethylene 1,1,2,2,3,3,3-heptafluoropropyl  
20 ether ( $\text{CF}_2=\text{CFOCF}_2\text{CF}_2\text{CF}_3$ ), perfluoropropyl epoxide ( $\text{CF}_3\text{CF}(\text{O})\text{CF}_2$ ), perfluoro-1-butene ( $\text{CF}_2=\text{CFCF}_2\text{CF}_3$ ), perfluorohexenes ( $\text{C}_6\text{F}_{12}$ ), perfluorononenes ( $\text{C}_9\text{F}_{18}$ ), perfluorohexane ( $\text{C}_6\text{F}_{14}$ ), perfluorocyclobutane ( $c\text{-C}_4\text{F}_8$ ), iodotrifluoromethyl ( $\text{CF}_3\text{I}$ ), 1,1,1,2,3,3-hexafluoropropane  
25 ( $\text{CF}_3\text{CFHCF}_2\text{H}$ ), 1,1,1,3,3-hexafluoropropane ( $\text{CF}_3\text{CH}_2\text{CF}_3$ ),

- 1,1,1,2,3,3,3-heptafluoropropane ( $\text{CF}_3\text{CFHCF}_3$ ) ,  
pentafluoroethane ( $\text{CF}_3\text{CF}_2\text{H}$ ) , tetrafluoroethanes ( $\text{CHF}_2\text{CHF}_2$ ,  
 $\text{CF}_3\text{CFH}_2$ ) , trifluoromethane ( $\text{CF}_3\text{H}$ ) , 1,1,2,2,3,3,4,4-  
octafluorobutane ( $\text{CF}_2\text{HCF}_2\text{CF}_2\text{CF}_2\text{H}$ ) , 1,1,1,2,2,3,4,5,5,5-  
5 decafluoropentane ( $\text{CF}_3\text{CF}_2\text{CFHCFHCF}_3$ ) , 2-trifluoromethyl-  
1,1,1,2,3,4,5,5,5-nonafluoropentane ( $\text{C}_6\text{F}_{12}\text{H}_2$ ) ,  
3,3,4,4,5,5,6,6,6-nonafluoro-1-hexene ( $\text{F}(\text{CF}_2)_4\text{CH}=\text{CH}_2$ ) ,  
2,3,3,4,4,5,5-heptafluoro-1-pentene ( $\text{CH}_2\text{CFCF}_2\text{CF}_2\text{CF}_2\text{H}$ ) ,  
trifluoroethylene ( $\text{CF}_2\text{CFH}$ ) , 1,1,2,2-tetrafluoroethyl  
10 difluoromethyl ether ( $\text{CF}_2\text{HCF}_2\text{OCHF}_2$ ) , 1,1,2,2-  
tetrafluoroethyl methyl ether ( $\text{CF}_2\text{HCF}_2\text{OCH}_3$ ) , 2,2,2-  
trifluoroethyl 1,1,2,2-tetrafluoroethyl ether  
( $\text{CF}_3\text{CH}_2\text{OCF}_2\text{CF}_2\text{H}$ ) , 1,1,2,3,3,3-pentafluoropropyl methyl  
ether ( $\text{CF}_3\text{CFHCF}_2\text{OCH}_3$ ) , nonafluorobutyl methyl ether  
15 ( $\text{C}_4\text{F}_9\text{OCH}_3$ ) , 1-trifluoromethyl-1,2,2,2-tetrafluoroethyl  
methyl ether (( $\text{CF}_3$ )<sub>2</sub> $\text{CFOCH}_3$ ) , perfluoropropyl methyl ether  
( $\text{CF}_3\text{CF}_2\text{CF}_2\text{OCH}_3$ ) , 2,2,3,3,3-pentafluoropropyl difluoromethyl  
ether ( $\text{CF}_3\text{CF}_2\text{CH}_2\text{OCHF}_2$ ) , 1,2,3,3,4,4-hexafluorocyclobutane  
(c- $\text{C}_4\text{F}_6\text{H}_2$ ) , 2,3-dichlorooctafluorobutane ( $\text{CF}_3\text{CFClCFClCF}_3$ ,  
20 boiling point: 63°C) , 1-chloro-1,1,2,2,3,3,4,4-  
octafluorobutane ( $\text{CF}_2\text{ClCF}_2\text{CF}_2\text{CF}_2\text{H}$ , boiling point: 50°C) ,  
1,2-dichlorohexafluorocyclobutane (- $\text{CFClCFClCF}_2\text{CF}_2-$  ,  
boiling point: 60°C) , and 1,1,1,3,3,3-hexafluoropropan-2-  
ol ( $\text{CF}_3\text{CH(OH)CF}_3$  , boiling point: 59°C) .  
25 10. A process according to Claim 1 or 2, wherein

the halogen-containing compound is 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea: CF<sub>3</sub>CFHCF<sub>3</sub>).

11. A process according to Claim 1 or 2, wherein  
the proportion of halogen-containing compound is about 1  
5 to about 49 mol per 100 mol of HFC-365mfc and halogen-  
containing compound in total.

12. A process according to Claim 1 or 2, wherein  
the catalyst is a tertiary amine, an organometallic  
compound, or a mixture thereof.

10 13. An organic blowing agent for producing a  
synthetic resin foam, the organic blowing agent comprising  
1,1,1,3,3-pentafluorobutane and at least one halogen-  
containing compound.

14. A blowing agent according to Claim 13  
15 further comprising at least one member selected from the  
group consisting of glycol compounds and amide compounds.

15. A blowing agent according to Claim 13  
further comprising at least one glycol compound.

16. A blowing agent according to Claim 13,  
20 wherein the halogen-containing compound is 1,1,1,2,3,3,3-  
heptafluoropropane (HFC227ea: CF<sub>3</sub>CFHCF<sub>3</sub>).

17. A premix for producing a synthetic resin  
foam, the premix comprising 1,1,1,3,3-pentafluorobutane,  
at least one halogen-containing compound and at least one  
25 polyol.

18. A premix according to Claim 17 further comprising at least one member selected from the group consisting of glycol compounds and amide compounds.

19. A premix according to Claim 17 further  
5 comprising at least one glycol compound.

20. A premix according to Claim 17, wherein the halogen-containing compound is 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea: CF<sub>3</sub>CFHCF<sub>3</sub>).

21. A premix according to Claim 17 or 18 that is  
10 nonflammable.